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12.0 Construction Costs

12.1 Introduction

The construction costs itemized in Appendix A are to aid the user in estimating the cost of bridge projects. The costs are based on historical data retrieved from recent WSDOT Contracts.

Requests for cost estimates from outside offices should be submitted in writing to the Bridge Projects Unit and a written response will be sent within a reasonable time. Estimates requiring input from the Bridge Design Section will take longer due to project schedule priorities.

Telephone requests for cost estimates from outside the Bridge and Structures Office shall be referred to the Bridge Projects Unit.

All cost estimates prepared by the Bridge and Structures Office should have the concurrence of the Bridge Projects Engineer.

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12.2 Factors Affecting Costs

12.2.1 Type of Structure

Many factors, as outlined in Section 2.2.3, must be considered in the selection of the type, size, and location of a bridge or wall.

Common structures with normal detail will be on the low end and mid-range of costs. Unique or complex structures will be on the high end.

12.2.2 Location of Project Site

Projects in remote areas or with difficult access will generally be on the high end of the cost range, and sometimes beyond.

12.2.3 Size of Project Contract

Small projects tend to be on the high end of the cost range while large projects tend to be on the low end of the cost range.

12.2.4 Foundation Requirements

Foundation requirements greatly affect costs. Water crossings requiring seals and piles are generally very expensive. Scour requirements can push the costs even higher. The earlier foundation information can be made available the more accurate the cost estimate will be. The Bridge Projects Unit should be made aware of unusual foundation requirements or changes to foundation type as soon as possible for updating of the estimate.

12.2.5 Sequencing of Project

Projects with stage construction, detours, temporary construction, etc., will be more expensive.

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Criteria

Construction Costs

Factors Affecting Costs

12.3 Development of Cost Estimates

Estimates prepared by the Bridge and Structures Office shall include mobilization but not sales tax, engineering, construction contingencies, or inflation.

12.3.1 Types**A. Prospectus and Project Summary Estimates**

Conceptual cost estimates are prepared when little information about the project is available. Use the construction costs in Appendix A, assuming the worst case conditions, unless actual conditions are known. An example of a worst case condition is pile supported footings. In remote areas, or for small projects, use the high end of the cost range. Use mid-range costs for usual conditions.

To cover unforeseen project modifications, add a 20 percent estimate contingency to a prospectus estimate and a 10 percent estimate contingency to a project summary estimate. These contingencies can be adjusted depending on the preliminary information available.

B. Preliminary Design Estimates

Preliminary design estimates are prepared during the preliminary design stage when the type and size of bridge is known. Limited foundation information is sometimes available at this stage. The construction costs in Appendix A shall be used with an appropriate inflation factor, assuming the worst case conditions, unless foundation conditions are known, along with a minimum of 10 percent contingency to cover scope creep.

For bridge rehabilitation projects, add a minimum 20 percent contingency amount to specific items, such as mechanical rehabilitation and structural steel repair, to cover potential increases in costs that often surface after indepth inspections are completed.

C. Estimate Updates During Design

During the design period, the designer should keep the Bridge Projects Unit informed of significant changes to the design that might affect the cost. Examples of significant changes are: deeper than expected footing and seals, use of piles when none were expected, change of substructure types, and changes to superstructure. This is a critical element in the project budgeting process.

D. Contract Estimates

The contract estimate is prepared by the Bridge Projects Unit after the Plans and Final Quantities have been submitted to the Bridge Projects Unit for final processing. The contract estimate is prepared using the quantities furnished by the Design Section, unit bid prices from Appendix A, other historical data, and the judgment of the engineer preparing the estimate. Unique, one-of-a-kind projects require special consideration and should include an appropriate construction cost contingency.

12.3.2 Responsibilities**A. Bridge Projects Unit**

The Bridge Projects Unit is responsible for preparing the prospectus, project summary, preliminary, and final contract estimates and updating the preliminary estimate as needed during the design phase of the project.

The Bridge Projects Unit assists the regions and outside agencies, such as counties and cities, to prepare conceptual design report and preliminary estimates when requested in writing.

B. Designer

The designer is responsible for providing preliminary quantities and final quantities to the Bridge Projects Unit to aid in the updating of preliminary estimates and the preparation of contract estimates.

12.3.3 Documentation

Whenever a cost estimate is prepared by the Bridge and Structures Office for an outside office, a Cost Estimate Summary sheet (Form 230-040) shall be filled out by the engineer preparing the estimate. The Cost Estimate Summary shall be maintained in the Job File. During the design stage, the summary sheet shall be maintained by the Structural Design Unit. It is the design unit supervisor's responsibility to ensure the summary sheet is up to date when the job file is submitted to the Bridge Projects Unit.

12.3.4 Cost Data**A. General**

The bridge costs summarized in Appendix A represent common highway, railroad, and water crossings. Consult the Bridge Projects Engineer for structures spanning across large rivers or canyons and other structures requiring high clearances or special design and construction features.

The square foot costs are useful in the conceptual and preliminary design stages when details or quantities are not available. The various factors affecting costs as outlined in Section 12.2 must be considered in selecting the square foot cost for a particular project. As a general rule, projects including none or few of the high-cost factors will be close to the mid-range of the cost figures. Projects including many of the cost factors will be on the high side. The user must exercise good judgment to determine reasonable costs. During the preliminary stage, it is better to be on the conservative side for budgeting purposes.

B. Square Foot Area

Compute the square foot area to be used with the square foot cost shall be computed as follows:

Bridge Widenings and New Bridges

The area of bridges is based on the actual width of the new portion of the roadway slab constructed (measured to the outside edge of the roadway slab) times the length, measured from end of wingwall to end of wingwall, end of curtain wall to end of curtain wall, or back to back of pavement seat if there are no wingwalls or curtain walls. Wingwalls are defined as walls without footings which are cast monolithically with the bridge abutment wall and may extend past the abutment footing. Curtain walls are defined as walls that are cast monolithically with the bridge abutment wall and footing and only extend to the edge of footing.

Bridge Rail Replacement

The bridge rail and curb removal is based on the total length of the rail and curb removed.

Bridge Lengths With Unequal Wingwalls

If a bridge has wingwalls or curtain walls of unequal length on opposite sides at a bridge end or wingwalls or curtain walls on one side of a pier only, the length used in computing the square foot area is the average length of the walls. If the wingwalls are not parallel to the centerline of the bridge, the measurement is taken from a projected line from the end of the wingwall normal to the centerline of the roadway.

Retaining Walls

If retaining walls (walls that are not monolithic with the abutment) extend from the end of the bridge, the cost of these walls is computed separately. The area of the wall is based on the height from the top of footing to the top of the wall.

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Criteria

Construction Costs

Development of Cost Estimates

BRIDGE DESIGN MANUAL

Appendix A

Construction Costs

Bridge and Structures Estimating Aids

BRIDGE AND STRUCTURES

(Note: Unit structure costs include mobilization
but do not include sales tax, engineering, or contingency)

		LOW	AVERAGE	HIGH ΔΔ
PRESTRESSED CONCRETE GIRDERS				
SPAN 50-140 FT.				
Water Crossing w/piling	SF	\$ <u>80.00</u>	\$ <u>95.00</u>	\$ <u>125.00</u>
Water Crossing w/spread footings	SF	<u>75.00</u>	<u>90.00</u>	<u>110.00</u>
Dry Crossing w/piling	SF	<u>80.00</u>	<u>90.00</u>	<u>105.00</u>
Dry Crossing w/spread footings	SF	<u>65.00</u>	<u>75.00</u>	<u>95.00</u>
REINFORCED CONCRETE AND POST-TENSIONED CONCRETE BOX GIRDER-SPAN 50-200 FT.				
Water Crossing w/piling	SF	<u>90.00</u>	<u>110.00</u>	<u>140.00</u>
Water Crossing w/spread footings	SF	<u>80.00</u>	<u>100.00</u>	<u>125.00</u>
Dry Crossing w/piling	SF	<u>85.00</u>	<u>105.00</u>	<u>125.00</u>
Dry Crossing w/spread footings	SF	<u>70.00</u>	<u>95.00</u>	<u>115.00</u>
REINFORCED CONCRETE FLAT SLAB	SF	<u>50.00</u>	<u>70.00</u>	<u>90.00</u>
SPAN 20-60 FT.				
PRESTRESSED CONCRETE SLABS	SF	<u>60.00</u>	<u>75.00</u>	<u>100.00</u>
SPAN 13-69 FT.				
PRESTRESSED CONCRETE DECKED BULB-TEE GIRDER	SF	<u>85.00</u>	<u>95.00</u>	<u>120.00</u>
SPAN 40-115 FT.				
STEEL GIRDER — SPAN 60-400 FT.	SF	105.00	125.00	<u>180.00</u>
STEEL TRUSS — SPAN 300-700 FT.	SF		<u>140.00*</u>	
STEEL ARCH — SPAN 30-400 FT.	SF		<u>150.00*</u>	
CONCRETE BRIDGE REMOVAL	SF	10.00	25.00	40.00
WIDENING EXISTING CONCRETE BRIDGES (Including Removal)	SF	<u>120.00</u>	<u>140.00</u>	<u>200.00</u>
RAILROAD UNDERCROSSING — SINGLE TRACK	LF		\$7,000.00*(Steel Underdeck Girder) \$8,000.00*(Steel Thru-Girder)	
RAILROAD UNDERCROSSING — DOUBLE TRACK	LF		\$11,000.00*	

BRIDGE AND STRUCTURES

(Continued)

		LOW	AVERAGE	HIGH ΔΔ
PEDESTRIAN BRIDGE	SF	\$ <u>100.00</u>	\$ <u>150.00</u>	\$ <u>200.00</u>
— REINFORCED CONCRETE				
REINFORCED CONCRETE RIGID	SF		80.00*	
FRAME (TUNNEL)				
REPLACING EXISTING CURBS &	LF	100.00	150.00	200.00
BARRIER WITH NEW JERSEY				
BARRIER (INCLUDING REMOVAL)				
REINFORCED CONCRETE	SF	35.00	50.00	65.00
RETAINING WALL				
(EXPOSED AREA)				
SOLDIER PILE TIEBACK WALL	SF	100.00	120.00	150.00
(EXPOSED AREA)				
MSE WALL				
PRECAST CONCRETE PANELS	SF	<u>15</u>	<u>25</u>	35
MSE WALL				
WELDED WIRE	SF	<u>12</u>	<u>20</u>	25
MSE WALL				
CIP CONCRETE FACE	SF	30	35	40
SOIL NAIL WALL	SF	20	30	40
CONCRETE FACING				
PERMANENT GEOSYNTHETIC WALL	SF	<u>12</u>	<u>20</u>	30
CONCRETE CRIB WALL				
CONCRETE HEADERS	SF	20	30	40

*Based on limited cost data. Check with the Bridge Support Engineer.

Bridge areas are computed as follows:

Typical Bridges: Width x Length

Width: Total width of deck, including portion under the barrier.

Length: Distance between back of pavement seats, or for a bridge having wingwalls, 3'-0" behind the top of the embankment slope; typically end of wingwall to end of wingwall, reference Standard Plans H9.

Special Cases:

Widenings — Actual area of new construction.

Tunnel — Outside dimension from top of footing to top of footing over the tunnel roof, i.e., including walls and top width.

ΔΔ For small jobs (less than \$100,000), use the high end of the cost range as a starting point.

BRIDGE DESIGN MANUAL

Appendix A

Construction Costs

Substructure Estimating Aids

SUBSTRUCTURE

BID ITEMS	UNIT	COST/UNIT ΔΔ		
Structure Excavation Class A Incl. Haul				
Earth	Cu. Yd.	\$ 10.00	—	\$ 25.00
Rock	Cu. Yd.	100.00	—	200.00
Inside Cofferdam — Earth	Cu. Yd.	20.00	—	30.00
— Rock	Cu. Yd.	100.00	—	175.00
Shoring Extra Excavation Class A				
Dry — Depth under 6'	Sq. Ft.	2.00	—	6.00
Dry — 6' - 10'	Sq. Ft.	6.00	—	10.00
Dry — 10' - 20'	Sq. Ft.	10.00	—	20.00
Cofferdam	Sq. Ft.	25.00	—	35.00
Preboring For Standard Piles	Lin. Ft.	30.00	—	50.00
Furnishing & Driving Test Piles				
Concrete	Each	3,000.00	—	5,000.00
Steel	Each	3,000.00	—	4,000.00
Timber	Each	1,500.00	—	2,500.00
Furnishing Piling				
Conc. _____ Diam.	Lin. Ft.	30.00	—	40.00
Steel — TYP HP 12x53	Lin. Ft.	25.00	—	30.00
Timber — Creosote Treated	Lin. Ft.	8.00	—	10.00
Timber — Untreated	Lin. Ft.	7.00	—	9.00
Pile Tip				
CIP Concrete (Steel Casing — Short Tip)	Each	150.00	—	200.00
CIP Concrete (Steel Casing — 10 Stinger)	Each	4,000.00	—	5,000.00
Steel (H-Pile)	Each	100.00	—	200.00
Timber (Arrow Tip)	Each	20.00	—	40.00
Driving Piles (40' - 70' Lengths)				
Concrete _____ Diam.	Each	400.00	—	800.00
Steel	Each	300.00	—	700.00
Timber	Each	200.00	—	400.00
Shafts				
Soil Excavtion For Shaft Including Haul	Cu. Yd.	200.00		450.00
Rock Excavation For Shaft Including Haul	Cu. Yd.	350.00		650.00
Furnishing and Placing Temp. Casing For Shaft	Lin. Ft.	100.00		300.00
Furnishing Permanent Steel Casing For Shaft	Lin. Ft.	100.00		600.00
Placing Permanent Steel Casing For Shaft	Each	1,000.00		1,500.00
Shoring or Extra Excavation cl. A — Shaft	Est.	10,000.00		25,000.00
Conc. Class 4000P For Shaft	Cu. Yd.	150.00		200.00

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Appendix A

Construction Costs

Substructure Estimating Aids

St. Reinf. Bar For Shaft	Lb.	<u>0.45</u>		<u>0.50</u>
CSL Access Tubes	Lin. Ft.	1.50		3.50
Force Account Remvoing Obstrucitons For Shaft	Est.	10% of all of above shaft _____		
St. Reinf. Bar For Bridge	Lbs.	<u>0.50</u>	—	<u>0.70</u>
Epoxy-Coated St. Reinf. Bar For Bridge	Lbs.	<u>0.65</u>	—	<u>0.85</u>
Conc. Class 4000W	Cu. Yd.	<u>125.00</u>	—	<u>200.00</u>
Conc. Class 4000P	Cu. Yd.	<u>125.00</u>	—	<u>200.00</u>
Conc. Class 4000 (Footings)	Cu. Yd.	300.00	—	400.00
Conc. Class 4000 (Abut. & Ret. Walls)	Cu. Yd.	<u>350.00</u>	—	<u>450.00</u>
Conc. Class 5000	Cu. Yd.	350.00	—	450.00
Lean Concrete	Cu. Yd.	<u>120.00</u>	—	<u>140.00</u>
Concrete Class 4000 P (CIP Piling)	Cu. Yd.	<u>120.00</u>	—	<u>180.00</u>

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Appendix A

Construction Costs

Superstructure Estimating Aids

SUPERSTRUCTURE				
BID ITEMS	UNIT	COST/UNIT ΔΔ		
Elastomeric Bearing Pads				
Girder Seat	Each	\$ 100.00	—	\$ 120.00
Girder Stop	Each	60.00	—	80.00
Spherical and Disc, Bearings (In place with plates)	Kip	10.00	—	12.00
Fabric Pad Bearing (In place, including all plates, TFE, etc.)	Each	1,000.00	—	2,000.00
Prestressed Concrete Girder				
W42G (Series 6)	Lin. Ft.	90.00		
W50G (Series 8)	Lin. Ft.	95.00		
W58G (Series 10)	Lin. Ft.	105.00		
W74G (Series 14)	Lin. Ft.	115.00		
W83G	Lin. Ft.	150.00		
W95G	Lin. Ft.	175.00		
Structural Carbon Steel (Steel girder, etc. when large amount of steel is involved)	Lbs.	0.90	—	1.40
Structural Low Alloy Steel (Steel girder, etc. when large amount of steel is involved)	Lbs.	1.10	—	1.50
Structural Steel (Sign supports, etc. when small amounts of steel are involved)	Lbs.	3.00	—	5.00
Timber & Lumber				
Creosote Treated	MBM	1,500.00	—	2,000.00
Salts Treated	MBM	1,800.00	—	2,500.00
Untreated	MBM	1,000.00	—	1,500.00
Lagging (in place) Untreated	MBM	1,400.00	—	1,800.00
Lagging (in place) Creosote Treated	MBM	1,900.00	—	2,500.00
Expansion Joint Modification	Lin. Ft.	300.00	—	400.00
Expansion Joint System				
Compression Seal	Lin. Ft.	30.00	—	50.00
Modular (Approx. \$100 per inch of movement)	Lin. Ft.	750.00	—	2,500.00
Strip Seal	Lin. Ft.	125.00	—	250.00
Bridge Drains	Each	300.00	—	500.00
Bridge Grate Inlets	Each	1,200.00	—	1,500.00
Conc. Class 5000	Cu. Yd.	500.00	—	650.00
Con. Class 5000 (Segmental Constr.)	Cu. Yd.	650.00	—	750.00
Con. Class 4000D (Deck Only)	Cu. Yd.	500.00	—	600.00
Conc. Class 4000	Cu. Yd.	450.00	—	550.00

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Appendix A

Construction Costs

Superstructure Estimating Aids

SUPERSTRUCTURE

(Continued)

BID ITEMS	UNIT	COST/UNIT ΔΔ		
Concrete Class EA (Exposed Aggregate)	Cu. Yd.	350.00	—	500.00
Concrete Class 4000 LS (Low Shrinkage)	Cu. Yd.	\$300.00	—	\$400.00
Concrete Class 5000 LS	Cu. Yd.	400.00	—	500.00
St. Reinf. Bar	Lb.	0.50	—	0.70
Epoxy-Coated Steel Reinforcing Bar	Lb.	0.65	—	0.85
Post-tensioning Prestressing Steel (Includes Anchorages)	Lbs.	1.50	—	2.50
Traffic Barrier	Lin. Ft.	55.00	—	75.00
Metal Railing (Type BP & BP-B)	Lin. Ft.	35.00	—	55.00
Metal Railing (Thrie Beam)	Lin. Ft.	40.00	—	65.00
Modified Conc. Overlay	C.F.	25.00	—	60.00
Furnishing and Curing Modified Conc. Overlay	Sq. Yd.	40.00	—	70.00
Scarifying Conc. Overlay	Sq. Yd.	8.00	—	12.00
Polymer Concrete	Sq. Yd.	45.00	—	100.00

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Appendix A

Construction Costs

Miscellaneous Estimating Aids

<i>Miscellaneous</i>				
BID ITEMS	UNIT	COST/UNIT ΔΔ		
Electrical Conduit, metal 2≤	Lin. Ft.	\$ 8.00	—	\$ 15.00
Sign Support (Brackets, Mono, or Truss Sign Bridges)	Lbs.	2.00	—	4.00
Concrete Surface Finishes				
Fractured Fin Finish	Sq. Yd.	17.00	—	28.00
Exposed Aggregate Finish*	Sq. Yd.	17.00	—	22.00
Pigmented Sealer	Sq. Yd.	5.00	—	8.00
~ *Requires the use of concrete Class EA				
Painting Existing Steel Bridges (Lead Base)	Ton. (Steel)	500.00	—	700.00
Painting New Steel Bridges	Lb. (Steel)	.08	—	.10
Mobilization	Sum of Items		10%	
Masonry Drilling Δ				
Holes up to 1 foot deep				
1" diameter	24.00			
1½"	25.00			
2"	28.00			
2½"	30.00			
3"	32.50			
3½"	42.50			
4"	47.50			
5"	53.00			
6"	60.00			
7"	77.00			
Δ For holes greater than 1-foot deep up to 20 feet deep, use 1.5 × above prices.				
If drilling through steel reinforcing, add \$16.00 per lineal inch of steel drilled.				
Removal of Rails and Curbs	Lin. Ft.	\$ 80.00	—	\$130.00
Removal of Rails, Curbs, and Slab	Sq. Ft.	25.00	—	50.00
Further Deck Preparation	Cu. Ft.	100.00	—	150.00
Bridge Deck Repair	Cu. Ft.	110.00	—	160.00
Removing ACP from bridge deck	Sq. Yd.	6.00	—	10.00

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Appendix A

Construction Costs

Miscellaneous Estimating Aids
